ASC ENGINEERING FACT SHEET

... An Engineering Success Story

F119 Engines Power F-22 Raptor To New Heights

DESCRIPTION

The engine that powers the F-22 Raptor, the F119-PW-100, is being developed by a team of engineers in the Propulsion Development System Office (DSO). The F119 engine acquisition team, led by Mr. David Edmunds, has adopted many of the Acquisition Reform and Lean Aircraft initiatives. As a result, the F119 Program has achieved many successes in recent years.

SUMMARY

Problem:

- The development and flight clearance of new engine designs has been a slow, burdensome, and costly process due in part to oppressive contractual and data requirements. In addition, aircraft flight test programs have typically encountered extensive delays as a result of engine technical shortfalls that have gone undetected during ground testing.

Solution:

- By utilizing the principles of Acquisition Reform and Lean Aircraft initiatives, the F-22 engine team in ASC/LPR streamlined the F119 program to achieve substantial cycle time reductions for technical information flow and configuration upgrades. These streamlined processes enhanced the implementation of the F119 Propulsion and Power Systems Integrity Program (PPSIP), to substantially improve the systems engineering process for the F119 engine. As a result, F119 design weaknesses were exposed earlier in development and corrective actions were implemented prior to manifesting themselves at flight test, providing for a more efficient and successful F-22 flight test program.

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The F119 team set the standard for the F-22 SPO in promoting Acquisition Reform and the use of best practices. Eighty-eight percent (164) of the F119 Program contract military specifications and standards were eliminated. The number of F119 Program contract data requirements list (CDRLs) was reduced by 72 percent. The F119 Statement of Work page count was reduced 50 percent. The cycle time for contractor/government contract technical information flow was reduced from 60 days to 2 weeks. The F119 team has implemented the use of a shared government/contractor real-time electronic data exchange system to capitalize on the benefits of CDRL reductions and to facilitate the reduction in cycle time for technical information flow. Extensive use of video conferencing has also enhanced the technical information flow process and reduced travel by over 75 percent.

The efforts of the F119 engineers have paid huge dividends for F-22 flight test. Twenty-five F119 flight test engines have been delivered to power the F-22 Raptors at flight test. The F119 engine has performed flawlessly during flight test, enabling the F-22 to achieve key milestones. The F-22/F119 has flown to 50,000 feet, has supercruised in excess of 1.5 Mach, has exceeded 7 G's, has reached 60 degrees angle of attack, and has accumulated more than 860 hours of flight test.

The F119 ground test program continues to achieve new milestones as well. A significant portion of the F119 development and verification testing is being conducted in state-of-the-art test facilities at the Arnold Engineering and Development Center (AEDC). The F119 engine has been tested extensively at various combinations of altitude and Mach number while being exposed to simulated F-22 maneuvers that produce engine inlet conditions of distorted, unstable, low-pressure air. In addition, the F119 engine has undergone rigorous accelerated mission testing (AMT) in a one-of-a-kind dedicated AEDC sea level test facility at simulated F-22 high speed, high pressure inlet air conditions. The F119 engineers in the Propulsion DSO have worked in concert with their counterparts at Pratt & Whitney and AEDC to continuously refine and streamline the AEDC testing to achieve test objectives at the lowest possible cost. The F119 engines have been tested for over 14,500 total accumulated cycles (TACs) and 11,000 hours of run time.

Since its inception, the F119 EMD program has fully embraced the EN systems engineering process, with special emphasis on the integrity programs. The F119 Propulsion and Power Systems Integrity Program (PPSIP) has been a key factor in the development and maturation of the F119 engine design. PPSIP broadened the integrity process beyond the historical engine structural integrity program (ENSIP). PPSIP expands the integrity process to encompass not only the structural but also the performance, operability, and functional aspects of the entire propulsion system, including engine controls, accessories, and external subsystems.

The PPSIP program's development and verification methodology has ensured that the F119 engine design is being thoroughly evaluated during the EMD phase of the program. As an example of the aggressive testing concepts embodied in the PPSIP program, the F119 accelerated mission testing has accomplished over 75 percent of the full life hot time exposure in just 40 percent of the test time. The PPSIP program has exposed several initial F119 design weaknesses and allowed for corrective action prior to the problems manifesting themselves at flight test, providing for a more efficient and successful F-22 flight test program.

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